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## BIOLOGICAL WARFARE

MR. GEORGE W. MERCK, United States Government Consultant for Biological Warfare, emphasised in his report for 1946 that the possibilities of mass destruction through biological weapons have not been as precisely assessed as in the case of the atomic weapons; also, that unlike the development of atomic energy, the production of these latter can be carried on without much expenditure of money, or construction of large factories, and under the camaflouge of legitimate bacteriological research.

That this is by no means an overstatement has been proved by the proceedings of the recent trial of twelve senior Japanese officers, who were accused by the Soviet of carrying on bacterioloical warfare against Russia. According to the indictment, a research station with a staff of about 3,000 scientists had been in operation in Manchuria since 1936 for the large scale production of bubonic plague, typhus anthrax and cholera. Fleas were bred in 4500 incubators, and apparently, an epidemic of plague had been experimentally introduced in Southern China in 1941 and 1942. One of the accused, a Japanese general in the Army, is said to have given full details of the type and design of weapons used for such purposes. These included small sprays fitted with walking sticks and fountain pens, but the main agents were porcelain bombs to be dropped from aircraft. American, Chinese and Russian prisoners of war are reported to have been used in the trials.

The above should open the eyes of everyone that the technical difficulties in the matter of improvising effective international supervision with a view to control are even greater for the biologicals than for the other case.

In this context, the recent statement of

Mr. Trygve Lie, United Nations Secretary-General, is indeed very disquieting. It says, "When the Atomic Energy Commission was created in 1946, the General Assembly entrusted it with the responsibility for working out proposals for the elimination from national armaments not only of atomic weapons, but 'of all other major weapons of mass destruction.' The Commission, however, has never discussed these other weapons, such as biological and chemical poisons. Some of these may be even more destructive of human life than atomic weapons. We do not know by experience what they might do. Unlike the atomic bomb, they were not used in the Second World War, although we know they existed then and have been further developed since. Even a preliminary study of the problem of establishing international controls for such weapons and providing safeguards against violations might lead to conclusions shedding new light upon what is necessary and attainable in the international control of atomic energy."

Thus, it would seem that even if effective control of atomic weapons could be achieved, there would still be left alternative methods of mass destruction which call for elimination. We feel that herein is a danger whose possibilities must be explored to its roots without any further delay, preferably by an International Commission of Biological Scientists, to whom must be assigned the difficult and responsible task of suggesting, after thorough investigation, ways and means of preventing biological warfare from becoming as serious a threat to civilization as atomic warfare.

## BRITISH COMMONWEALTH COLLECTIONS OF MICRO-ORGANISMS

BY decision of the Specialist Conference held in London in 1947,* a British Commonwealth Committee was established to promote the preservation of micro-organisms in collections readily accessible to workers in all parts of the Commonwealth. The initial task was to find out what cultures were being kept in collections, university departments, and other laboratories; when this was competed, attempts would be made to fill the lacunæ revealed.

Questionnaires were sent to laboratories in all parts of the Commonwealth asking for information on the number and types of micro-organisms maintained, and whether these would be made available to other workers. The response to this questionnaire was variable but sufficient progress has been made to justify publication of a Directory of culture collections in the United Kingdom. About 90 collections are named in the first edition of the Directory, which is to be supplemented by a List of the species maintained by them.

National Committees have been appointed in most of the co-operating countries, and it is anticipated that similar Directories and Lists will be prepared for other parts of the Commonwealth. All workers who have specialised collections, or who maintain cultures for teaching purposes, are asked to co-operate by getting in touch with their National Committee from whom copies of the first edition of the U.K. Directory can be obtained. The Convener of the Indian National Committee is Prof. M. Sreenivasaya, Asst. Professor of Fermentation Technology, Indian Institute of Science, Bangalore 3.

*Report of Proceedings*, published by H. M. S. O. Code No. 47-139. Price 6*d*. net.

## OPPORTUNITIES FOR STUDY ABROAD

About 22,000 fellowships and scholarships, founded by various countries and international organisations and involving a total investment of 100 million dollars per year are available in different countries. Information regarding these is given in "Study Abroad", a Unesco publication which has been rcently released.

The publication is the result of a second world-wide enquiry regarding fellowships, scholarships or awards available during the years 1949-50, 1950-51 and 1951-52. The first volume of this publication was published in 1948 as a result of a survey conducted by Unesco in all member States.

Besides listing the various opportunities for study available in different countries, the volume contains extensive surveys of programmes for short teaching abroad and workers exchanges for educational and cultural purposes. It also gives valuable information about some 180 national and international organisations in Europe sponsoring international educational exchanges of young people.

## ULTRA-VIOLET RADIATION IN INDUSTRY*

SOME of the many uses of ultra-violet radiation in modern industry formed the subject of a recent demonstration by Hanovia, Ltd., at the company's showrooms in Victoria Street. Broadly speaking, the industrial applications are of two kinds; in one, the ultra-violet radiation is used to produce some specific photo-chemical or physical change, such as, for example, the ageing of paint; in the other, the radiation is used simply as a detecting agency. Numerous examples of both categories, as applied to diverse industries, were exhibited.

One exhibit which will be of considerable interest to mining technologists consisted of a portable battery-operated ultra-violet lamp which can be conveniently carried on prospecting surveys. When irradiated by this lamp minerals, including uranium and scheelite (tungsten ore), fluoresce in characteristic colours. The equipment is particularly useful for detecting the presence of scheelite, which fluoresces only in response to a narrow waveband, including 2537 Å, and this particular wavelength forms about 90 per cent. of the radiation of the new lamp. In its commercial form the lamp is mounted in a light alloy housing, fitted with a carrying handle. A two-way switch operates the ultra-violet lamp as well as a flash-lamp bulb which provides general illumination when required. The equipment is suitable for mains or battery operation, and it is self-contained in a hardwood box the size of an ordinary attaché case.

A different technique is used for the identification of mercury. The mineral specimen is placed in an ultra-violet beam and is heated by a blow-pipe flame. If mercury vapour is given off shadows will be thrown on a fluorescent screen irradiated by the beam, the shadows being caused by the fact that the mercury vapour absorbs the appropriate wavelengths from the beam, which originates from a mercury vapour lamp.

Fluorescence forms the basis of a very simple test which was demonstrated for detecting the presence of aluminium in water. A concentration of 1 part in 10 million can be detected. A similar method can be used for tracing contamination in water supplies. For example, if a cesspool is suspected of leaking through subterranean cracks into a well, this suspicion can be tested by putting a little fluorescent liquid into the cesspool and subsequently irradiating samples of well water under the ultra-violet lamp. Any fluorescence in the samples proves the source of contamination.

Fluorescence under ultra-violet radiation is used in a very wide range of industries for testing groups of materials and for discriminating between the qualities of similar substances in a particular group.

For example, the shell of a new-laid egg, when exposed to a source of ultra-violet radiation, will fluoresce a delicate rose colour. Stale eggs, on the other hand, will produce a blue or violet fluorescence. Sugars, jams and honey may be similarly tested; in jams, the presence of apple pulp can be shown while turnip pulp, sucrose, molasses and glucose can be disclosed. In brewing, the qualities of barley can be distinguished by their individual fluorescence. The testing of oils and fats, including butter, margarine, lard, cocoa butter and cheese is simplified by fluorescent analysis. In Gorgonzola and Roquefort cheese the living fungi show a brilliant green fluorescence which is absent in dead fungi. In other cheeses the ripening can be followed by use of the ultra-violet lamp, new cheese showing a yellow fluorescence which turns to blue as ripening proceeds.

Ultra-violet lamps are adopted for all types of routine tests in textile production, tanning, paper manufacture, the making of paints and varnishes, rubber industry and so on. In textiles, fibres of all types can be differentiated. There are many ways in which the fluorescence test helps the paper manufacturer. It is possible to distinguish bleached from unbleached pulps, to estimate the nature and amount of loading used and to discover spots and blemishes on finished papers. In the colour and varnish industry the established uses are for distinguishing between gums and phenol-formaldehyde or urea-resins, and for testing the purity of wax and drying oils.

One group of exhibits indicated how the motor industry uses fluorescence analysis to detect the presence of unwanted grease on sheet metal surfaces undergoing preparation for finishing; to distinguish between lubricating oils of different origins and properties, and to trace unwanted mineral oils in brake fluid. Another group of exhibits showed that the uses of ultra-violet in the rubber industry range from the identification and grading of fillers, softeners, vulcanisers, and pigments to the detection of oil on tyre fabric before processing.

Many industries make use of ultra-violet radiation in quite a different way—in the pro-

* By Courtesy of the *British Information Services.*

duction of controlled photo-chemical changes. For example, the ultra-violet lamp is commonly used for accelerating fading and ageing processes: to determine the resistance of dyed fabrics, paints and inks to sunlight, and to examine the conditions governing the ageing of rubber, bitumen and similar substances. The exhibits drawn from the automobile industry included a section designed to illustrate ageing and fading tests on safety glass, paint finish and upholstery materials. To illustrate the testing of paints and bitumen finishes photographs were exhibited showing the extensive installations of ultra-violet lamps at the Building Research Station and at the Paints Division of Imperial Chemical Industries, Ltd. Among these exhibits were samples of magnesium alloy showing the effect of six cycles of weathering test and also showing the protection afforded by temporary corrosion preventatives after twelve similar weathering cycles.

Finally, photo-chemical changes induced by ultra-violet radiation can be used productively in a recently developed process whereby acrylic sheets are cemented in such a way that the joint does not impair the excellent optical properties of the material. In this process cement is applied to the pieces to be jointed; irradiation by ultra-violet light then converts the joint into a solid homogeneous whole.

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## SEX HORMONES*

PROGRESS in sex hormones has been very rapid, but books reporting it are few. The second edition of the book, *Biological Action of Sex Hormone*, will therefore receive a warm welcome by all those who wish to gain insight into the fundamental aspects of sex hormones. In this volume, the author has included recent rapid developments in the field and has succeeded in presenting a co-ordinated summary of contributions in the field and their practical application.

According to the author the purpose of the book is to survey the present knowledge of sex hormones and to acquaint the readers with the methods employed by the scientists in their research. The book is divided in six parts. The first part which includes Chapters I to IV concerns gonadotrophins of the pituitary and placenta. Discussing the nature and functions of gonadotrophins, the author remarks that its chemical nature has not been exactly determined, but it has been established that the pituitary and placental gonadotrophins are not identical. Evidence of a difference between the gonadotrophins derived from pituitary and placenta is afforded in this chapter. In subsequent chapters the author deals with factors which influence the gonadotrophic activity of the pituitary, factors which influence the reaction of gonads to gonadotrophins and the factors which affect the cytological structure and weight of the anterior lobe of pituitary.

Part II deals with a general view of the gonadal hormones. After a general preview the author discusses the experimental inquiry into the nature and action of sex hormones. The chemical structure of the three main types of gonadal hormones—œstradiol, testosterone and progesterone—has the same basis and the divergence from the common pattern which account for the diverse actions of these hormones in the body are seemingly slight.

Part III which includes Chapters VI to X relates to androgen, its action on reproductive organs before and after their complete differentiation, the action of androgen on accessory generative organs and on tissue and organs other than these. The first experimental demonstration of hormonal action by testes was made by John Hunter (1794) and later on Brown Séquard (1889) tried testicular extract on himself. The effects were not very striking. Subsequently various other workers carried on investigations on the effects of testicular hormone on different organs and noted the results. With the results obtained by these pioneers to give encouragement, a rapidly growing volume of research has been done and the author has referred to some of these.

Part IV, Chapters XI to XX, is concerned with œstrogens. It gives a brief consideration of the source, metabolism and excretion of œstrogens, gradient of responsiveness, and reversibility of the effects. The action of œstrogens on embryonic gonads and Mullerian and Wolffian system, on the anterior lobe of pituitary and on the gonads after their differentiation, on the accessory genital organs, has been very elaborately discussed. Discussing the factors in the causation of mammary cancer the author quotes that long before the identification of œstrone, the ovary was thought to be an agent

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* *Biological Action of Sex Hormones.* By Harold Burrows, Second Edition (Cambridge: At the University Press) 1949. Pp. xiii+615 Price 42 *s.*

in the development of cancer of the breast. Numerous observations have been made regarding the role of œstrogen in mammary cancer and there is evidence that in women œstrogens are concerned in the etiology of breast cancer. Not only does the clinical evidence point to such conclusion, but now cases are being reported in which cancer of the breast has followed prolonged treatment with œstrogen. The effects of œstrogen on connective tissue, skin, liver, pancreas, blood vessels, thymus and adrenals have also been dealt with in two chapters.

The fifth part surveys the sources, and metabolism of progestins—the active principles of the corpora lutea of the ovary, and their biological action. The main action is on pituitary, on embryonal development, on testes and ovary and accessory genital organs. The progestins play an important part on the œstrous cycle and menstruation. The action of progesterone on the uterus are intimately concerned with reproduction, nidation of ova, pregnancy and parturition. References have also been made to the co-operative and antagonistic effects of œstrogen and progestin and of action common to progestin and adrenal cortical hormone.

The sixth and the concluding section describes the sex hormones of adrenal cortex, pituitary-adrenal relationship, adrenal-gonad relationship and the inactivation of deoxycorticosterone by the liver. Probably the fate of adrenal steroids resembles that of gonadal hormone, but much has yet to be learned about this metabolism.

The international units of sex hormone activity are given in the appendix and are very useful. At the end of the book there is a bibliography which helps the readers to refer to other literature on the subject for additional information.

The author has attempted to cover the entire subject and the treatment is fairly comprehensive and to the point. Emphasis has been laid upon experimental aspects and upon the evidence which these give in support of various theories. The volume is well printed in clear type and is admirably produced. It is educative and commends itself to students of biology and medicine and to all who have academical or professional interest in the subject of sex hormones.

N. N. De.

## INDIAN DAIRY SCIENCE ASSOCIATION

THE Third Annual General Body Meeting of the Indian Dairy Science Association was held on 1st March 1950, at the Indian Dairy Research Institute, Bangalore, Dr. K. C. Sen, Director of Dairy Research, presiding.

This Association, founded in 1947, with the object of furthering the advancement of dairy science, has made noteworthy progress in all directions. One of its most important tasks is the publication of the *Indian Journal of Dairy Science*. A non technical monthly, *The Indian Dairyman*, is also being published under the joint auspices of this Association and the Bangalore Dairy Cattle Society for disseminating knowledge to the layman.

In their Report, the Secretaries of the Association described the various activities of the Association and appealed to the dairy scientists industrialists and other persons interested in the progress of dairy industry in India to strengthen the Association by enrolling as members and giving liberal donations. Sir Datar Singh was re-elected as President of the Association.

In his Presidential Address (read by the Chairman) Sir Datar Singh pointed out the need for re-orienting our cattle and dairy development policy keeping in view our present resources, the conditions of milk production and the purchasing power of our people. For increasing milk production we have more and more to depend on the co-operation of the people both in the productive sphere as well as in the marketing side and must organise producers' and consumers' co-operative societies. Considerable advance in this direction has been made in Madras, Bombay, Uttar Pradesh and elsewhere. The Indian Council of Agricultural Research had sponsored the Key Village Scheme for providing approved breeding bulls, giving technical and veterinary aid to the producers, supply of cattle feeds at reasonable rates and castration of all scrub bulls. Reference was also made to the useful role played by Gaushalas and Pinjrapoles in the development of cattle wealth and to the potentialities of the well-organised Military Dairy Farms all over the country. Sir Datar drew particular attention to the practice of adulteration of milk and milk products which must be eliminated quickly if the marketing of milk and milk products is to be organised successfully.

# PLANT MICROFOSSILS FROM PALANA LIGNITE EOCENE, BIKANER

A. R. RAO AND K. P. VIMAL

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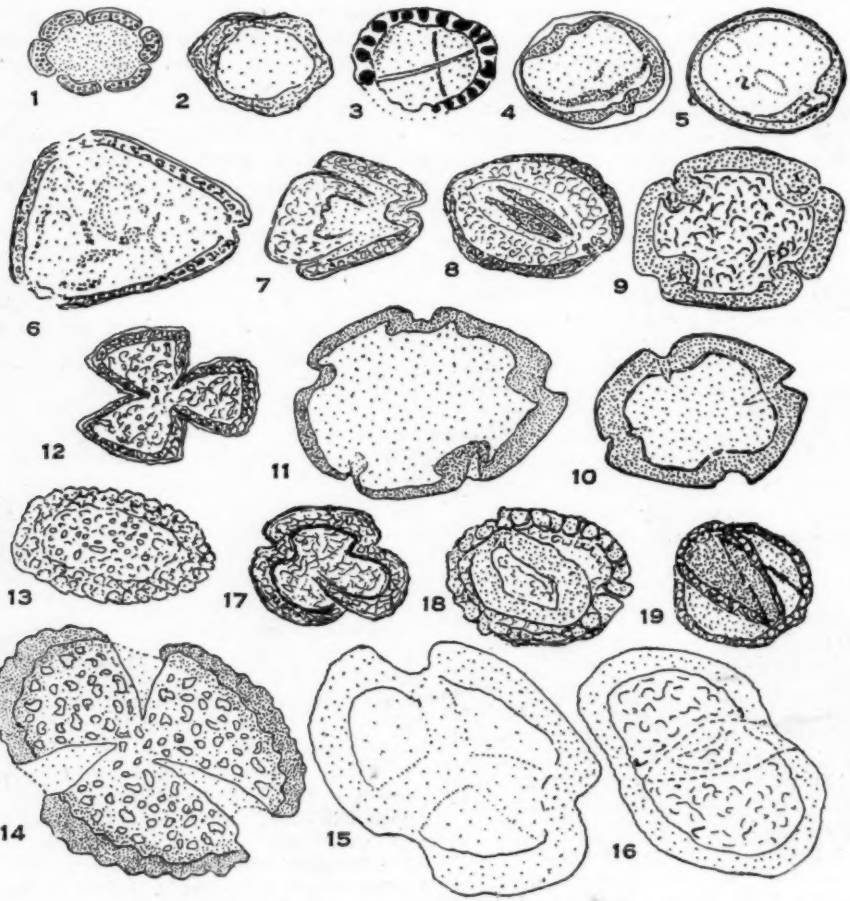
SOME samples of lignite from Palana (? Eocene) in Bikaner* on analysis, were found to contain carbonised wood, plant cuticles and other microfossils. Examination of the recently macerated material of this *lignite* showed at least ten different types of microfossils which are briefly described here.

The microfossils appear to be mostly pollen grains, with no trace of pteridophytic spores with trirdiate marks. Types 5, 7, 9 and 10 appear to be tricolpate in form; Type 6 is generally tetra-




1 and 2; type 1, polar and equatorial views respectively. 3; type 2. 4 and 5; type 3, equatorial views at different foci; the clear elliptic areas seen in fig. 5 may be germ pores. 6; type 4, polar view 7-8; oblique polar and equatorial views respectively of the tricolpate type 5. 9-10; polar views at two different foci of the tetracolpate type 6. 11; a pentacolpate grain belonging to the same type. 12; polar view of the tricolpate type 7. 13; type 8. 14-15; polar views at different foci of the tricolpate type 9. 16; equatorial view of the same. 17-19; ype 10. 17; polar view. 18; equatorial view with two flanges in focus, 19; with only one flange in focus. All figures magnified 675 times.

* Collected in 1948, by Mr. S. S. Misra, M.Sc., and kindly placed at our disposal by Prof. S. R. Narayana Rao.

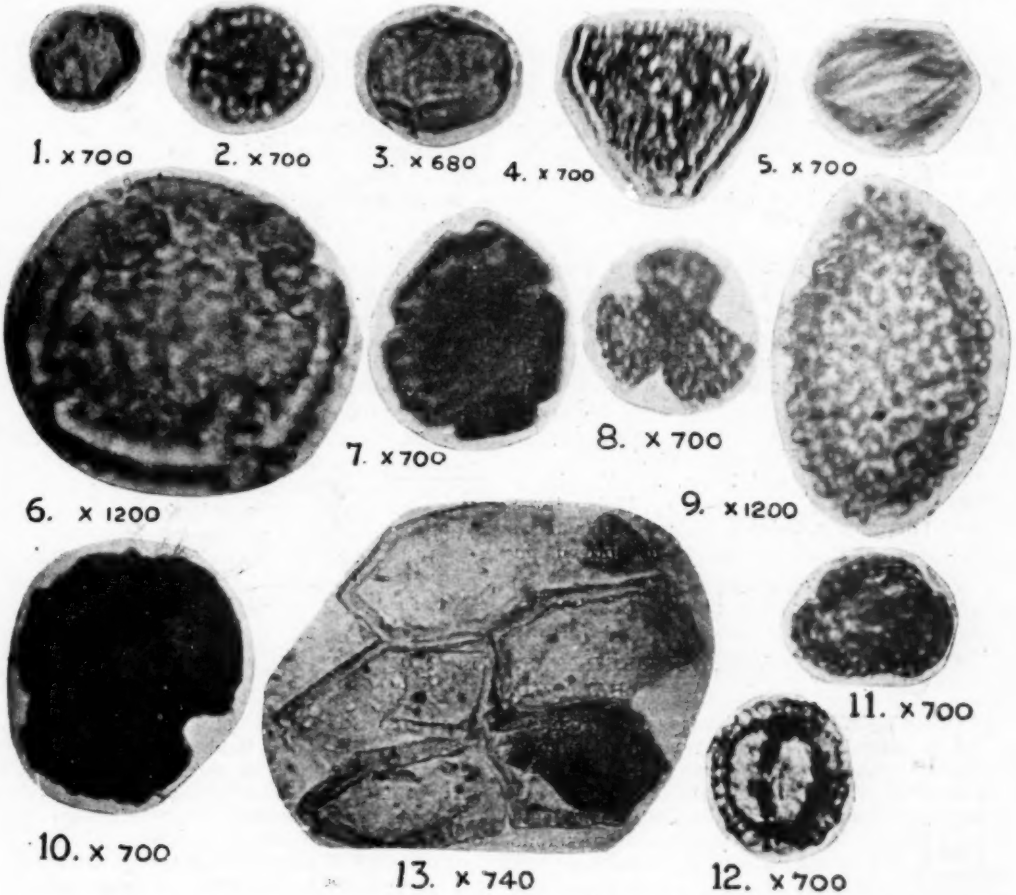
colpate and probably pentacolpate also. Type 1 appears to be hexacolpate, but its structure is still obscure. Types 9 and 10 correspond to the brachytrilistrium type of Naumova.[1] Type 8 without any pores or furrows can be classed under Aporina of the same author. The structure of type 2 could not be clearly made out.

DESCRIPTION

*Type* 1 (*Fig.* 1-2, *Photo.* 1).—Polar view elliptic (Fig. 1 and Photo. 1), 20·8 $\mu \times$ 22·4 $\mu$, six lobed, exine thick with thin hyaline cuticle-like outside layer, inner layer 2½ time as broad, granular, surface smooth; equatorial view (Fig. 2) broadly elliptic, 24·0 $\mu \times$ 12·8 $\mu$, with the two poles likely thicker. In the equatorial view can be seen six thin slits coresponding to the five gaps in the exine seen in the polar view. These are not shown in the figure; they may be the germinal pores or furrows. Ligrt yellow in colour.

*Type* 2 (*Fig.* 3 *and Photo.* 2).—Equotorial view almost rotundate, 24·0 $\mu \times$ 24·0 $\mu$ (Fig. 3 and Photo. 2), exine thick, surface negatively reticulate, germ pores not clear. Two thin slits, one equatorial and the other vertical but a little to the right of the median line, are seen (Fig. 3). Light brown in colour.

*Type* 3 (*Figs.* 4, 5 *and Photo.* 3).—Probably




1—Polar view of type 1. 2—Equatorial view of type 2. 3—Probably equatorial view of type 3. 4—Equatorial view of type 4. 5—Oblique polar view of type 5. 6—Polar view of tetracolpate type 6. 7—Polar view of pentacolpate grain of same type. 8—Equatorial view of type 7. 9. Probably polar view of type 8. 10—Oblique polar view of the tricolpate type 9. 11—Polar view. 12—Equatorial view of type 10. 13—Surface view of cuticle.

equatorial view, oval 20·8 $\mu \times$ 32·0 $\mu$ (Fig. 4), exine thick with a thin cutin-like layer, exine further thickened at the poles, surface smooth; (Fig. 5) oval, the three oval translucent areas which appear along the equatorial line at a different focus, may be the germ pores. Brown in colour.

*Type* 4 (*Fig.* 6 *and Photo.* 4).—Equatorial view triangular, 44·8 $\mu \times$ 38·4 $\mu$, exine thick, granular with thin cuticle, pores three, one at each angle. Yellow in colour.

*Type* 5 (*Figs.* 7-8 *and Photo.* 5).—Tricolpate. Oblique polar view (Fig. 7) 28·8 $\mu \times$ 32·0 $\mu$; equatorial view (Fig. 8) 35·2 $\mu \times$ 30·4 $\mu$, the two median thickenings in Fig. 8 are perhaps the two ridges of the wall which are seen in the polar view. Exine thick, surface uneven, negatively reticulate. Brown in colour. The grain resembles in appearance but not in size the pollen grain of *Cornus amomum*.

*Type* 6 (*Figs.* 9-10 *and Photo.* 6)—Tetracolpate. Polar view (Fig. 9), 38·4 $\mu \times$ 43·2 $\mu$, colpæ diagonally placed, walls folded inwards, germinal slits thin and narrow along the colpæ (Fig. 10), exine thick, surface smooth. Brown in colour. A pentacolpate grain whose oblique polar view is seen in Fig. 11 and Photo. 7, belongs perhaps to the same type although there is some difference in size. The grain resembles in appearance and to a certain extent in size also, the pollen of *Tilia americana*.[3]

*Type* 7 (*Fig.* 12 *and Photo.* 8).—Tricolpate. Polar view (Fig. 12,), 35·5 $\mu \times$ 33·6 $\mu$, three lobed, clefts deep, exine thick, granular surface reticulate and sculptured. Light brown in colour.

*Type* 8 (*Fig.* 13 *and Photo.* 9).—Probably equatorial view, elliptic, 25·6 $\mu \times$ 44·8 $\mu$, no furrow or germ pore seen. Photo. 9 shows the surface of the grain covered by dome-shaped structures which are responsible for the sscrobiculate sculpture of the exine. A comparison in appearance but not in size, can be made with the pollen grains of *Potamogeton natans*.[4] Wall dark brown in colour, body lighter.

*Type* 9 (*Figs.* 14, 15, 16 *and Photo* 10.)—Tricolpate, brachitrilistrium type. Oblique polar views (Figs. 14 and 15) at the higher and lower foci respectively, 57·6 $\mu \times$ 56·0 $\mu$, three flanged, flanges cleft upto the middle of the grain exine thick with reticulate thickenings. Equatorial view (Fig. 16), 56·0 $\mu \times$ 38·4 $\mu$. Dark brown in colour.

*Type* 10 (*Figs.* 17, 18, 19 *and Photos.* 11-12).—Tricolpate, brachitrilistrium type, polar view (Fig. 17 and Photo. 11), 28·8 $\mu \times$ 33·6 $\mu$, exine thick, surface with reticulate thickenings; equatorial view with the two flanges in focus (Fig. 18 and Photo. 12) 33·6 $\mu \times$ 32·0 $\mu$; oblique equatorial view with one flange in focus (Fig. 19 28·0 $\mu \times$ 27·2 $\mu$) Light brown in colour.

Cuticle (Photo. 13) with epidermal cells measuring about 44·8 $\mu \times$ 24·0 $\mu$, average thickness of wall 4·0 $\mu$. Yellow in colour.

This investigation has been carried on with the help of a grant awarded by the Scientific Research Committee of the U.P. Government.

1. Naumova, S. N., "Spores and pollen oft he coals of U.S.S.R.," *Rep.* XVII, *International Gological Congress*, 1, 353-64. 2. Erdtman, G., *An Introduction to Pollen Analysis*, 1943, 85, fig. 143. 3.—, G., *Loc. cit.*, 123, fig. 359. 4. Wodehouse, R. P., *Pollen Grains*, 1935, 221, fig. 8.

## IRREGUALR SEGREGATIONS IN YEAST HYBRIDS

BALAJI D. MUNDKUR

DEVIATIONS in tetrad segregation from the 2:2 Mendelian expectation in heterozygous *Saccharomyces* hybrids have recently been attributed (Winge and Roberts[1]) to a degeneration of four nuclei from an initially 8-nucleate complement. A chance survival of any four nuclei from among the gametic products of two successive mitoses (following a reduction of the hybrid nucleus) has been considered an explanation for 2 : 2, 3 : 1, 1 : 3, 4 : 0 and 0 : 4 ascus types. This view is based on their analysis of four 5- and 6-spored heterozygous asci genetically marked for one character only—the fermentation of maltose—and is adopted as an alternative explanation to that held by Winkler[2], Lindegren[3], and Mundkur[4].

The following considerations, based on data presented earlier, will indicate the inadequacy of employing a single genetical marker in investigating non-Mendelian inheritance.

1. Five different crosses involving from five to ten genetical markers (Mundkur[1]) yielded asci in which segregations of loci determining the fermentation of various sugars and the syntheses of a purine and some B vitamins were markedly disturbed. In spite of the extensive non-Mendelian ratios for such markers, segregations of mating type specificity ($a$ and $\alpha$ segregants) conformed to the expected 2 : 2 Mendelian ratio in all but three of twenty-four 4-spored asci. Clones from the three exceptional asci mated with neither $a$ nor $\alpha$ standard

testers. No irregularities of mating type segregation were descernible in ten other 3-spored asci. Mating reactions of each segregant from these thirty-four asci were tested against both *a* and *α* standard haplophase clones. This behaviour is not consistent with the explanation advanced by Winge and Roberts since the *a/α* alleles would not be exempted from irregularities on their hypothesis.

2. Mundkur[4] found that among these same asci the adenine independent white haplophase parents AD* (W) when crossed to adenine deficient, pink haplophase parents *ad*(P) yielded tetrads of the constitutions AD(W) AD(W) AD(W) AD(W); AD(W) AD(W) *ad*(W) *ad*(W); *ad*(W) *ad*(W) *ad*(W) AD(W); and *ad*(P) *ad*(P) AD(W) AD(W). It had been demonstrated previously[5] that the pink clones are generally associated with adenine dependence.

3. Meiosis is completed in two successive divisions. No matter how many genes may be involved, a single reduction division can produce a maximum of four different genotypes and no more. Subsequent divisions of the nuclei derived from the tetrad do not increase the variety of genotypes. This fact has been amply confirmed by analyses of 8-spored asci of *Neurospora*. More than four kinds of clones from a single 8-spored ascus have never been reported, no matter how many genes have been heterozygous in the hybrid. A hybrid heterozygous for two pairs of genes can produce only four kinds of progeny. One heterozygous for three or more pairs is potentially capable of producing 8 or more genotypes. On Mendelian theory, however, each single tetrad can produce only 4 kinds of clones, irrespective of the heterozygosis of the hybrid. Winge and Roberts' explanation of irregular segregations is automatically excluded since it can be shown to require more than 4 genotypes in a single tetrad. For example, the tetrad listed below (Lindegren[3], page 25-2) produced three pink cultures and one white culture:

5919 *a G IN PN PY s TH AD*(W)
5920 *a g in pn py S th ad*(P)
5921 *a g IN pn PY s TH ad*(P)
5922 *a G in PN Py S th ad*(P)

The three pink cultures are genetically different at two loci, *e.g.*, *g in*, *g IN*, *G in*. The white culture is different from the three pinks being, G *IN*. If eight nuclei had been produced and four had died, it would be necessary to account for one absent pink and three absent white clones without increasing the variety of genotypes beyond the maximum, namely, four. Inspection reveals that this cannot be done. For example, if culture *G IN* were white it would not increase the variety of genotypes, but two more white cultures must be accounted for. If the *g in* culture were white, the reduction would have produced five kinds of segregants and if the *g IN* culture were white, six kinds of clones would have resulted from the reduction: *G IN* (*White*), *g in* (*Pink*), g in (White), *g IN* (*Pink*), g IN (White), *G in* (*Pink*). The italics designate clones grown from the ascus; the roman letters indicate clones required by Winge and Roberts' hypothesis.

4. Mundkur[4] reported a mating (C1A × 3349) which yielded a tetrad of the following constitution. It is discussed as an example; many similar tetrads were found. (The cross was heterozygous for all the markers used).

M532 *a G ME MG MA ad*(W) *pn in*
M533 *a G ME MG ma ad*(W) *pn in*
M534 *a g ME MG MA AD*(W) *PN IN*
M535 *a g me MG MA AD*(W) *PN IN*

On the basis of Winge and Roberts' view, each of the ascospores would necessarily have an identical twin, since each one is different and the maximum of four genotypes has been attained. This would, however, mean a 6 : 2 ratio for *ME/me*, an 8 : 0 ratio for *MG/mg*, and a 6 : 2 ratio for *MA/ma*, since the hybrid was heterozygous for these loci. In addition, the anomalous *ad*(W) appeared in this ascus.

This analysis proves that the origin of non-Mendelian, mature 4-spored asci is not amenable to Winge and Roberts' view that a random destruction of four nuclei occurs in an initially Mendelian, 8-nucleate complement. It is evident, moreover, that use of one marker alone in evaluating irregular segregations is deceptive, and that the greater the number of diagnostic genetical markers employed the easier it is to detect inadequacies in the interpretation advanced by Winge and Roberts.

I am indebted to Dr. Carl C. Lindegren for help in the preparation of this note.

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1. Winge, O., and Roberts, C., *Nature*, 1950, **165**, 157. 2. Winkler, H., Die Konversion, *der Gene. Jena.*, 1930. 3. Lindegren, C. C., *The Yeast Cell. Educational Publishers, Inc., St. Louis*, 1949. 4. Mundkur, B. D., *Ann. Missouri bot. Gard.*, 1949, **36**, 259. 5. Lindegren, C. C., and Lindegren, G., *Proc. Nat. Acad. Sci.*, (*US*) 1947 **33**, 314.

* *Abbreviations:*

*G/g*; *ME/me*, *MG/mg*, *MA/ma* and *S/s* indicate galactose, melibiose, alpha methyl glucoside, maltose, and sucrose fermentations, respectively. *AD/ad*, *PY/py*, *TH/th*, *PN/pn*, and *IN/in* indicate abilities (or inabilities) to synthesize adenine, pyridoxine, thiamin, pantothenate and inositol, respectively. P and W indicate pink and white clones.

## WHY STATISTICS*

FLUCTUATIONS are the fundamental feature of all measurements, whether they relate to the physical, biological or social sciences. But all contingent knowledge is based on measurements and observations which are subject to such variation. Each measurement or observation is only one of many possible similar sets, and hence there arise the statistical concept of a random sample from the totality of all such samples, i.e., the universe. These random samples enable one to draw valid conclusions about the universes from which they are drawn, with the aid of the calculus of probability. Such knowledge as is based on random samples is necessarily incomplete, and conclusions drawn therefrom, although valid, are uncertain. But it is possible to estimate the valid measure of the degree of uncertainty with the help of the calculus of probability. Thus we have the following paradox:

*If statistical theory is right, predictions must sometimes come out wrong; on the other hand if predictions are always right, then statistical theory must be wrong.*

This statistical or uncertain inference is in sharp contrast to deductive or absolutely certain conclusions. Pure mathematics is an example of such deductive logic. The certain inferences of deductive or deterministic views which once dominated the physical sciences have gradually given place to probabilistic-statistical inferences. All scientific knowledge being based upon evidences which are formally incomplete is only probable but never absolutely certain. Predictions based upon scientific knowledge must prove to be fallible or uncertain to an anticipated extent. But pure mathematics being fundamentally deductive in nature does not itself belong to the field of science.

The scope and range of the statistical method become larger and larger as they include within their domain the concepts of classical physics, the kinetic theory of gases, statistical mechanics and thermo-dynamics, biometry and so on, successively. At each successive stage, the importance of the fluctuations of variations in the phenomena become more and more marked and the statistical methods used for the study of these phenomena, more and more pronounced. Especially so is the case where more than one factor and their combinations have to be studied at one and the same time. Here the classical method of isolating and studying one factor at a time completely fails. It is only the statistical method of design of experiments and analysis of variance that can help us. In the industrial field also, where variations do exist, the statistical methods of quality control have enabled one to maintain the quality of manufactured products at a desired level. Statistical sampling is the most adaptable, rapid, economical and, in the true sense, scientific method of factual ascertainment in place of the traditional method of exhaustive census or attempted complete count. In certain cases where factors of variation are neither amenable to control nor to experimentation, the only approach possible is the statistical one. Thus statistics has supplied science with a general method for inductive inference and it has found growing practical applications in the affairs of everyday life. Statistics is essentially an applied science and in statistical research the greatest stimulus has always come from the need of solving practical problems.

Sample surveys with respect to crops are an instance in point. The advantages of such surveys over the older methods of complete-enumeration are greater speed, economy and precision. The governments not only in India but also elsewhere and the U.N.O. have now been increasingly aware of the importance and usefulness of such sample surveys.

In India, the present great urge for solving the vital national problems is giving real strength to the progress of statistics, and statistics, no doubt will play an important part in solving these problems.

M. C. SATYANARAYANA.

* Abstract of the Presidential Address of Prof. P. C. Mahalanobis, F. R. S., General President, at the 37th Session of the Indian Science Congress, Poona, 1950.

## DR. S. CHANDRASEKHAR

The Adams Prize, offered by the University of Cambridge, for an essay on a mathematical, astronomical, or natural philosophical subject, has been awarded this year, equally to Dr. S. Chandrasekhar, Chicago, Dr. J. C. Burkill, Cambridge, H. W. Hayman, Exeter, and Prof. J. M. Whittaker, Liverpool.

# LETTERS TO THE EDITOR


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## A NOTE ON THE COMPRESSIBILITY, VISCOSITY AND SURFACE TENSION OF AQUEOUS SOLUTIONS OF ALKALI HALIDES

Using Debye-Sears'[1] arrangement for the diffraction of light by ultrasonics, the ultrasonic velocity $v$, and hence the adiabatic compressibility $\beta$ have been determined from the relation $\beta = \frac{1}{v^2\rho}$ (where $\rho$ is the density determined by a sensitive Bunge balance) at different molar concentrations for the four alkali halides KI, KBr, KF, and NaF, as also their viscosity ($\eta$) and the surface tension (T) at the same temperature and atmospheric pressure. The values of $v$, $\beta$, $\eta$, T and $\rho$, at different concentrations, show two interesting empirical relations (1) between $\eta$ and $\beta$, and (2) between $v$, T and $\rho$, viz., (1) $\eta = 2{\cdot}0 \times 10^2\ \beta$, so that $\frac{\eta}{\beta}$ is a constant, for all the four halides, independent of temperature and concentration. ($\eta$ is expressed in $10^{-3}$ dynes/sq. cm./unit velocity gradient, and $\beta$ is expressed in $10^{-6}$ c.c./c.c./atm.) (2) $T = 1{\cdot}2 \times 10^{-6}\ \rho v^{3/2}$ so that $\frac{T}{\rho v^{3/2}}$ is a constant, $1{\cdot}2 \times 10^{-6}$, for all the four halides, independent of temperature and concentration.

Fuller details will be published elsewhere.

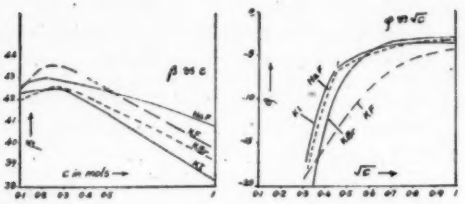
Andhra University, Waltair, *January* 28, 1950. B. H. Krishnamurty.

1. Debye and Sears, *Proc. Nat. Acad. Sci. Wash.*, 1932, **18**, 410.

## A NOTE ON THE ADIABATIC AND APPARENT MOLAR COMPRESSIBILITIES OF ALKALI HALIDES

Bachem[1] found that the adiabatic compressibility $\beta$ of aqueous solutions of electrolytes conformed to the relation $\beta = \beta o + Ac + Bc^{3/2}$, where $\beta$ is the adiabatic compressibility at the molar concentration c and $\beta o$ is that of water while A and B are constants, A being large and negative, and B small and positive. According to this equation therefore, $\beta$ should fall off progressively with increasing concentration. Similarly, the apparent molar compressibility $\phi_e$ of electrolytes at concentration c (which is a function of $\beta$), was found to be negative, and follow the linear relation, $\phi_e = a + b\sqrt{c}$, where a and b are constants (Gucker[2]).

In the present investigation the adiabatic compressibility $\beta$, and hence the apparent molar compressibility $\phi$ have been determined by the ultrasonic method, using the Debye-Sears'[3] arrangement for the diffraction of light by ultrasonics, for the four alkali halides KI, KBr, KF, and NaF, in the lower concentration ranges. The curves indicate the relation between $\beta$ and c and $\phi$ and $\sqrt{c}$.




The adiabatic compressibility in every case shows a maximum at a concen ration of nearly 0·3 mol., proving that for this range, Bachem's formula does not hold.

Again, the relation between $\phi$ and $\sqrt{c}$, for all the four halides is not linear as one would expect, thus departing from the Gucker's formula. $\phi$ is of course negative, as required by theory, but increases rapidly upto a concentration of 0·3 mol. and then rises rather slowly in all the four cases. Thus both the adiabatic and apparent molar compressibilities of these halides show departures from their expected types of behaviour with concentration, at the lower concentration ranges.

A fuller account of this work and a collective study of $v$. the ultrasonic velocity, $\beta$, $\phi$, $\eta$, the viscosity and T, surface tension will be published elsewhere.

Andhra University, Waltair, *January* 28, 1950.

BH. KRISHNAMURTY.

1. Bachem, *Zeit. f. Physik.*, 1936, **101**, 341. 2. Gucker, *Chem. Revs.*, 1933, **13**, 111. 3. Debye and Sears, *Proc. Nat. Acad. Sci. Wash.*, 1932, **18**, 410.

## ON CARBONACEOUS DISCS AND 'ALGAL DUST' FROM THE VINDHYANS PRE-CAMBRIAN

ATTENTION has been drawn previously by Misra[1] to the occurrence of (1) glauconite grains which are believed to be casts of organisms and (2) on alga (Dasycladacea) in the Vindhyan limestones. Further work has revealed two additional forms indicative of organic life. These are (1) Carbonaceous disc-like bodies, (2) algal dust.

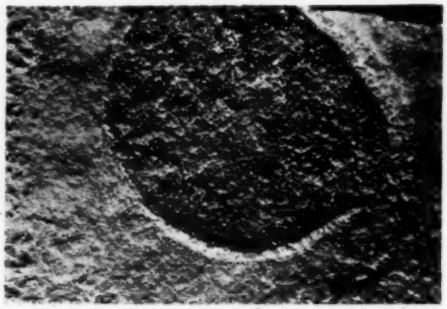


FIG. 1. Carbonaceous disc in Rohtas Limestone × 2. *Loc.*— Banjari, Shahabad District, Bihar.

1. *Carbonaceous disc-like bodies.*—The Banjari Carbonaceous Rohtas Limestones, which show thin lenticles of bright coaly matter, have yielded black (carbonaceous) disc like bodies, having a diameter of 26 mm. on the average. The margin of the discs is marked by a prominent raised border, and the surface is covered with bright black granular coaly matter. A transfer preparation made from a disc shows structureless carbonaceuos shreds, similar to those seen in the thin sections of coaly lenticles of the limestones. Similar carbonaceous discs but of smaller size (maximum 7 mm.) were discovered by Jones[2] from the Suket shales at Neemuch late described as primitive Brachiopods by Chapman.[3] Walcott and Resser[4] had suggested that the bodies represent true fossils and definitely brachiopods, which agreed most closely with forms of Acrothele from the Cambrian. The collection was finally studied by Sahni[5] who remarks, "firally, as Mr. Chapman has shown, these fossils are now completely carbonised, and although cases are known of chitinous fossils becoming carbonised, yet it is only an assumption that the present fossils were originally chitinous. However, in my opinion, it is not the carbonised character of the surface which is the real obstacle to regarding these discoidal bodies as brachiopods, but the lack of any features which may be definitely attributable to members of that class". Howell,[6] however, is more in favour of their being plant remains since when heated the shiny film of the fossil glowed and burnt to grey ash. A piece of a shell of a Middle Cambrian phosphatic specimen of *Acrothele* when tested in the same way did not burn. The close association of lenticles of coaly matter in the Banjari lime-

stones and the carbonaceous discoidal bodies and the similarity of their structure in thin sections strongly leads us to the suggestion that the discoidal bodies described here probably represent plant remains.

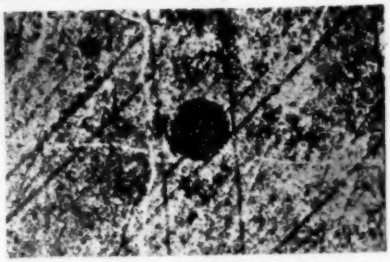


FIG. 2. Spherical body of 'ALGAL DUST', in Carbonaceous Rohtas Limestone. × 60.

*Loc.*— Banjari, Shahabad District, Bihar.

2. *Algal Dust.*—Thin sections of the sandy glauconitic limestones of the Lodwara hill (25° 13′ – 80° 55′) overlying the Bundelkhand granite, and the carbonaceous Rohtas limestones from the Banjari quarries, (south of Dehri-on-Sone, on the Dehri-Rohtas Light Railway) show dusty and dark patches and rounded discs in a clear matrix of grains of calcite, by transmitted light. By reflected light these appear porcellaneous, similar to the 'Algal Dust' described by Alan Wood[7] from the carbonaceous limestones of England. They are not carbonaceous, as pointed by Wood, they consist of minute grains of Ca $CO_3$ precipitated by the action of algæ. The spherical nature of the microscopic dusky bodies (maximum diameter ·145 mm.) in our material suggests some connection with algal spores.

We are highly indebted to Prof. S. R. Narayana Rao, under whose guidance this work is being conducted.

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University of Lucknow, R. C. MISRA.
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*January* 31, 1950.

1. Misra, R. C., *Curr. Sci.*, 1949, **18**, 12. 2. Jones, H. C., *Rec. Geol. Surv. Ind.*, 1909, **38**. 3. Chapman, F., *Ibid.*, 1935, **69**. 4. Walcott, C. D. and Resser, G. E., *Ibid.*, 1927, **60**. 5. Sahni, M. R., *Ibid.*, 1935, **67**. 6. Howell, B. F., *Ibid.*, 1928, **61**. 7. Wood, A., *Geol. Mag.*, 1941, **18**.

## ELASTIC CONSTANTS OF FUSED QUARTZ

THE elastic constants of fused quartz have been determined in the past by the well-known static method. However, independent determinations show wide variations amongst themselves. We have now determined these constants by three other methods; one is based on the thermal scattering of light, while the other two are dynamic methods based on ultrasonic excitation. Recently one of us[1] has succeeded in photographing one pair of Dopp'er shifted Brillouin components in the light scattered by fused quartz using λ 2536 excitation and a quartz 3 metre spectrograph. The shift of the components, as is well known, is related to the velocity of the sound waves which in turn depends on the elastic constants of the medium. The observed shift for transverse scattering was equal to ± 1·65 $cm.^{-1}$ Using this value and the known refractive index of fused quartz, the elastic constant $C_{11}$ is evaluated and entered in the accompanying table.

Using a thin plate of fused quartz, the elastic constants have also been determined by exciting the same at its mechanical resonant frequencies by a piezo-quartz plate of uniform thickness (Plate method).[2] The values of the elastic constants calculated from the observed resonant frequencies and the thickness of the plate are also given in the table. Lastly, the values of the elastic constants of fused quartz as determined by the well-known Schæfer-Bergmann[3] method are also entered in the same table. The specimens used in the above three methods are of the same origin. The agreement between the results obtained by these three methods is satisfactory.

| No. | Method | $C_{11} \times 10^{-11}$ dynes/$cm.^2$ | $n = \frac{C_{11} - C_{12}}{2} \times 10^{-11}$ dynes/$cm.^2$ |
|---|---|---|---|
| 1 | Light scattering | 7·70 | .. |
| 2 | Plate method | 7·85 | 3·05 |
| 3 | Schæfer-Bergmann method | 7·97 | 3·12 |
| | Static method | 7·38 | 3·03 |

The last row in the table gives the most probable values[4] of the constants as determined by the static methods. As is to be expected, the dynamic values are slightly higher than static ones.

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Ind. Inst. of Sci., R. V. G. SUNDARA RAO.
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*March* 10, 1950.

1. Krishnan, R. S., to be published. 2. Sundara Rao, R. V. G., *Ibid.*, 1948, **18**, 475. 3. Schæfer and Bergmann, *Naturwiss.*, 1935, **23**, 799. 4. *International Critical Tables*, 1928, **4**, p. 21.

## VANADAMETRY—PART VI
### Volumetric Estimation of Hydrazine with Sodium Vanadate

THE reaction between hydrazine and vanadic acid has received comparatively little attention, although, it was considered suitable by Hofmann and Kuspert[1] for the estimation of hydrazine as early as 1898. Browne and Shetterley[2] and Bray and Cuy[3] dismissed the method as being inaccurate, although the latter workers made the significant statement, "A weighted mean of all the results gave for the concentration of hydrazine solution the same value as that obtained later by the iodic acid method. This check is considered to be accidental and due to a compensation of errors". No details of the method were mentioned.

The present communication deals with the estimation of hydrazine with sodium vanadate solution. An excess (50 per cent. more than the required amount) of standard sodium vanadate (about 0·1N) solution was taken in a conical flask, enough sulphuric acid added to keep the overall concentration at 2N, and then the hydrazine solution was added. The mixture was heated to boiling, cooled and the excess vanadate titrated with a standard solution of Mohr's salt using diphenyl benzidine as the indicator. In another series the vanadyl salt formed by reduction of vanadate was determined by titration with standard potassium permanganate while hot. Both the procedures gave satisfactory results, although the former is more convenient. Preliminary experiments have shown that hydrazine sulphate cannot be titrated directly by running down sodium vanadate solution from the burette, either in the cold or in the hot (50° C.) as the reaction is not rapid enough, the first drop of vanadate solution giving the characteristic blue violet colour.

The results obtained by the Vandametric method compare most favourably with those by the potassium iodate method recommended by Jamieson[4] and Pennemann and Audrieth.[5]

Fuller details will be published elsewhere.

Chemistry Dept., Andhra University, & Mrs. A. V. N. College, Visakhapatnam,
*January* 24, 1950.

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V. BRAHMAJI RAO.
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1. Hofmann and Kuspert, *Ber.*, 1898, **31**, 64. 2. Browne and Shetterley, *J. Amer. Chem. Soc.*, 1907, **29**, 1305; 1909, **31**, 221; 1909, **31**, 783. 3. Bray and Cuy, *Ibid.*, 1924, **46**, 858. 4. Jamieson, *Amer. J. Sci.*, 1912, **33**, (4) 358. 5. Pennemann and Audrieth, *Anal. Chem.*, 1948, **20**, 1058.

## CONTROL OF SECONDARY INFECTION OF DOWNY MILDEW OF MAIZE

THE damage caused by downy mildew of maize was, according to report, very severe in Java and Belgian Congo,[1] while in India it was estimated to be slight by Butler[1], and by about 10% McRae[2]. The disease appeared in a severe form in September 1949 in a block of seven acres of maize in the area of the Indian Agricultural Research Institute, New Delhi. The incidence of the disease was 100 per cent and it appeared that the crop would be a failure. The affected plants showed stunted growth, the upper part having turned pale yellow owing to the disappearance of chlorophyll in the leaves in long streaks. Two distinct types of symptoms were visible, the chlorosis being more pronounced in one than in the other. The incidence of the severe type was about two per cent. The fungus was identified as *Sclerospora philippinensis* Weston.

Examination of the growing points of severely affected plants showed the presence of fungal hyphæ suggesting that the infection in these cases was systemic. In case of the plants showing milder type of infection hyphæ could not be traced in the growing points. The infection in such cases was probably secondary.

Spraying with Bordeaux mixture 5-5-50 was undertaken with a view to control the disease. The crop within a period of ten days after the spray, regained its normal colour. The severely affected plants did not recover from the disease. Even a second spraying failed to eliminate the disease from these plants. It, therefore, apears that secondary infection by downy mildew of maize can be controlled by spraying with Bordeaux mixture.

The writer is indebted to Dr. R. S. Vasudeva, Head of the Division of Mycology, Indian Agricultural Research Institute, for his helpful suggestions and criticism.

Division of Mycology and Plant Pathology,
Indian Agri. Res. Institute,
New Delhi,
*January* 14, 1950.

M. L. GATTANI.

1. Butler, E. J., *Fungi and Disease in Plants*, 1918. 2. McRae, W., "Report of the Imperial Mycologist," *Sci. Reports, Agr. Res. Inst. Pusa*, 1926-27, (1), 1928 **27**, 45-46. 1928.

## PURITY OF MILK

THE variations in surface tension of milk with adulteration are only slight, even upto 60%, according to Mahajan and Mathur[1]: naturally,

TABLE I

*Viscosity of whole and skimmed milk with different adulterations at 19° C. (Buffalo Milk)*

| | % of water \ Sample No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Mean viscosity ($\eta$) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Whole Milk | 0 | 1·72 | 1·76 | 1·76 | 1·72 | 1·72 | 1·75 | 1·76 | 1·74 | 1·75 | 1·74 | 1·74 |
| | 20 | 1·46 | 1·48 | 1·49 | 1·48 | 1·48 | 1·47 | 1·50 | 1·48 | .. | .. | 1·48 |
| | 40 | 1·37 | 1·39 | 1·39 | 1·32 | 1·33 | 1·36 | 1·38 | 1·36 | .. | .. | 1·36 |
| Skimmed Milk | 0 | 1·55 | 1·57 | 1·60 | 1·58 | 1·54 | 1·61 | 1·59 | 1·56 | 1·58 | 1·56 | 1·57 |
| | 20 | 1·43 | 1·42 | 1·44 | 1·39 | 1·46 | 1·45 | 1·45 | 1·41 | .. | .. | 1·43 |
| | 40 | 1·28 | 1·30 | 1·31 | 1·31 | 1·30 | 1·30 | 1·31 | 1·32 | 1·30 | .. | 1·30 |
| | 50% | Whole milk + 50% Skimmed milk | | | | | | | | | | 1·66 |

they are not of much utility for detecting the purity of milk, as claimed by the authors.

We find however that the viscous properties of milk change very appreciably at the above mentioned adulterations. The viscocity was determined by using the 'Ostwald Viscometer'.[2] The relative times of flow of a measured volume (10 c.c.) of the sample under test and of distilled water between two marked levels on the viscometer were determined and the viscosity ($\eta$) relative to water was calculated from the relation $\eta = d.\frac{t_2}{t_1}$ (taking the density of water and its viscosity as unity); $d$ is the density of milk and $t_1$ and $t_2$ are the times of flow of distilled water and the sample respectively. (Table 1).

With the addition of starch, we found that with (i) 1 gm. of starch in 10 c.c. of whole milk, $\eta = 2{\cdot}53 \pm 2\%$; (ii) 1 gm. of starch in 10 c.c. of whole milk and water added to make the density equal to that of pure milk, $\eta = 1{\cdot}66 \pm 2\%$.

From the above results it seems that it may be possible to utilize the viscosity determinations as a method for detecting water or starch adulterations. Detailed investigations on the standardisation of the viscometer will be reported in due course.

The authors are grateful to Dr. Sarna, Director of E.P.U. Physics Labs. for providing facilities; Mr. M. L. Lakhanpal for loan of the apparatus and Dr. Ram Chand for useful discussions. The investigation was financed by the senior author (O.P.)

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Hoshiarpur, E. Punjab, RAM.
*February* 6, 1950.

1. Mahajan, L. D., and Mathur, O. C., *Curr. Sci.*, 1949, **18**, 204. 2. Glasstone, S., *Physical Chemistry*, 1948, MacMillan & Co. Ltd., London, 493, Fig. 111.

## A SIMPLE METHOD FOR THE REMOVAL OF THE TOXIC ALKALOIDS FROM MUSTARD OIL ADULTERATED WITH ARGEMONE OIL

THE ingestion of mustard oil adulterated with argemone oil was found by Lal & Das Gupta[1] to be the causative factor of 'epidemic dropsy' in India. Argemone oil was reported to contain a substance of an alkaloidal nature[2] which was identified recently by Sarkar[3] to be a mixture of dihydro-sanguinarine and sanguinarine respectively. Sanguinarine was very toxic to rats and induced symptoms similar to those observed in cases of epidemic dropsy. The present note deals with a method by which the alkaloids of argemone oil can be easily eliminated from mustard oil adulterated with it, keeping the edible properties of the mustard oil unimpaired.

Pure mustard oil was adulterated with varying percentages of argemone oil expressed in our laboratory and was used for these experiments.

The oil could not be freed from the alkaloids by direct treatment with adsorbents such as activated alumina, silica gel or Fuller's earth or by heating it to 230° C. for about 15 minutes[4]; nor was it found possible to precipitate the alkaloids from the adulterated mustard oil with some of the edible salts of different metals such as ferric sulphate, ferric chloride, calcium phosphate, calcium oxide, acid potassium phosphate, etc., or by the ordinary akali treatment.

A partial separation of these alkaloids was however observed on treating the adulterated oil with some organic acids. Inorganic acids such as boric and phosphoric, which are considered to be the least harmful amongst edible inorganic acids, were therefore tried and it was observed that treatment of the adulterated mustard oil with pure phosphoric acid, the amount varying according to the percentage of adulteration with the argemone oil (about 1 to 1·5% of phosphoric acid for 10% adulteration was found satisfactory) at the ordinary temperature removed practically the whole of the alkaloids as insoluble phosphates together with little albuminoids and colouring matter of the original oil. Traces of alkaloids still remaining in the oil could be completely removed by shaking this acid-treated oil with about 2 per cent. of acid-activated Fuller's earth and filtering it through a filter press.

Excess of phosphoric acid in the oil was finally neutralised by the addition of a requisite amount of precipitated chalk and filtering the oil again through the filter press. The oil thus purified was found free from any alkaloid and gave neither any colour reaction with nitric acid nor produced any reddish brown flakes with the ferric chloride reagent of Sarkar[5]. The 'characteristics' as well as other physical properties of this treated oil differed little from those of the pure mustard oil excepting that a slight fading of colour and odour and a little reduction in specific gravity were noticed.

Detailed results of this work are awaiting publication elsewhere.

My best thanks are due to Dr. K. R. Krishnaswami, Director of Industries, Bihar, for his helpful criticism and advice and to Mr. S. K. Das Gupta for assistance in the analytical Work.

Prov. Ind. Res. Lab. A. C. Roy.
Science College,
Patna,
*December* 23, 1949.

1. Lal, R. B. and Das Gupta, A. C., *Ind. J. Med. Res.*, 1941, **29**, 157–65. 2. Mukherjee, *et al.*, *Ibid.*, 1941, **29**, 361. 3. Sarkar, *Nature*, 1948, **162**, 265–66. 4. Pasricha, *et al.*, *Ind. J. Med. Res.*, 1939, **27**, 947. 5. Sarkar., *An. Biochem. Exp. Med.*, 1941, **1**, 271; 1941, **2**, 101.

## METHIONINE AND CYSTINE CONTENTS OF THE GUINEA FOWL EGG

Guinea fowl (*Numida meleagris*) belongs to the order and family: *Numididæ*.

The bird whose eggs were procured for this investigation was fed *jawar* at home, and then it fed freely elsewhere. No specific diet could be arranged for this investigation, since guinea fowls, as a rule, do not lay eggs in captivity.

The white of the egg and the egg yolk were separated according to the method employed by Plimmer and Rosedale (*Biochem. Jour.*, 1925, 19, 1015) and dried. Total sulphur in these two portions was estimated by using sodium peroxide bomb, and cystine and methionine according to the specific methods of Callan and Toennies (*Ind. and Eng. Chem., Anal. Ed.*, 1941, 13, 450) and Horn, Jones, Blum (*Jour. Biol. Chem.*, 1946, 166, 313) respectively. Estimations were made in the case of egg yolk after it was treated with ether to extract ether-soluble fat. But since in literature references are given to egg yolks from which fat has not been removed, values obtained have been calculated to correspond to this. The results are given in the following table:

TABLE I

| | Total sulphur % | Cystine sulphur % | Methionine sulphur % |
|---|---|---|---|
| Egg white .. | 2·294 | 1·199 | 0·4107 |
| | 2·189 | 1·217 | 0·411 |
| Mean .. | (2·2415) | (1·208) | (0·4108) |
| Egg yolk .. | 2·511 | 1·015 | 0·4939 |
| (Freed from fat) | 2·449 | 1·005 | 0·4901 |
| Mean .. | (2·480) | (1·010) | (0·4920) |
| Egg yolk, *calculated*, on the basis that the fat was *not* moved | 1·698 | 0·6916 | 0·3370 |
| Total, for whole egg if the fat is not removed | 3·9395 | 1·8396 | 0·7478 |

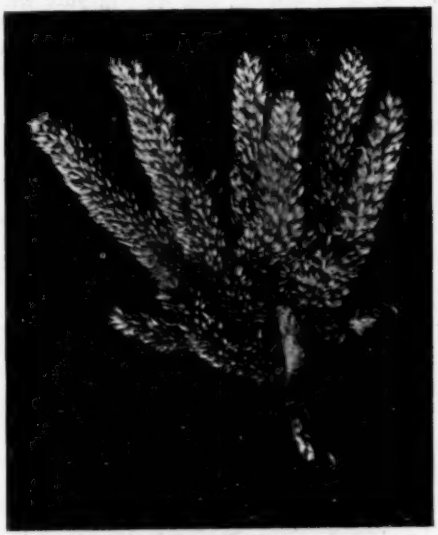
Unpublished work (Block and Bolling: Amino Acid Composition of Proteins and Foods, 1945 Edn., page 181) gives for whole hen egg, S, 1·5; cystine S, 0·6351; and methionine S, 0·8583 per cent. whereas Beach and Teague (*J. Biol. Chem.*, 1942, 142, 277) find in egg white alone S, 1·9; cystine S, 0·8467; and methionine S, 0·9446 per cent. In any case, guinea fowl egg appears to be richer in the total sulphur and cystine sulphur content.

Rajaram College, J. W. Airan.
Kolhapur, G. D. Kalyankar.
*January* 23, 1950.

## BRANCHED EARS IN *PENNISETUM TYPHOIDES* STAPF ET HUBBARD

We observed within an year two instances of branching inflorescence in bulk rainfed crops. A specimen with eleven branches was found at the Agricultural Farm, Coimbatore. These

cases of branching have been obtained under normal field conditions without X-irradiation or photoperiodic treatment.[1,2] The branching was



not found in any one of the hundred and odd progenies raised from the seeds collected from the plants with forked branches. No explanation of the above phenomenon can be offered at present. The authors will be glad to hear of similar observations from others.

Botany Section, Agric. Coll. & Res. Instt., Coimbatore, *January* 16, 1950.

S. N. CHANDRASEKHARAN.
D. DANIEL SUNDARARAJ.

1. Krishnaswamy, N., and Rangaswamy Ayyangar, *Proc. Ind. Acad. Sci.*, 1942, **16**, 1. 2. Chinoy, J. J., and Nanda, K. K., *Ind. J. Agri. Sci.*, 1946, **16**, 390.

## A MANGO CHIMAERA

THE mango variety *Alphonso* is cultivated on a large scale in the Bombay Presidency by grafting on seedlings used as root stocks. These occasionally exhibit chimæral nature.[1,2,3,4,5,6,7] In one case, a branch about 10 inches long bore two fruits of quite different shapes—one of the typical Alphonso type and the other having a prominent shoulder and a deep ventral cavity, these features being absent in the typical Alphonso fruit. It appears to be a case of mericlinal chimæra and during the fruiting season of 1949, almost all the fruits borne by the tree were found to be of the typical Alphonso type, except one which was of the type as described above. Further investigation is

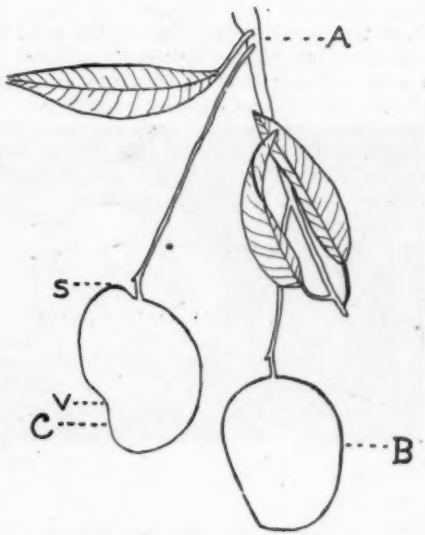



FIG. A—A branch of an Alphonso tree (a Mango Variety) B — Fruit of typical Alphonso type. C — Fruit of another type with shoulder (*S*) and Ventral Cavity (*V*)

necessary to decide its mode of origin i.e., whether it is autogenous or graft chimæra.

M. A. C. S. Laboratory, Poona 4, *November* 17, 1949.

BASUDEV ROY.

1. Buder, J. "Studien an Laburnum Adami I", *Ber. Deutsch. Bot. Ges.*, 1910, **28**, 188-92. 2. Castle, W. E., "An apple Chimæra", *J. Genet.*, 1914, **5**, 20. 3. Jorgensen, C. A., and Crane, M. B., "Formation and Morphology of Solanum Chimæras" *Ibid.*, 1927, **18**, 247-73. 4. Stout, A. B., "The establishment of varieties in Coleus by the selection of somatic variation," *Carneg. Inst. Wash. Pub.*, 1915, **218**, 1-80. 5. —, "A graft chimæra in the apple," *J. Hered.*, 1920. **11**, 233. 6. Winkler, H., Über Pfropfbastarde und pflanzliche Chimären," *Ber. Deutsch. Bot. Ges.*, 1907, **25**, 568-76. 7. —, "Die Chimärenforschung als Methode der experiment ellen Biologie," *Sitzber. Phys. Med. Ges. Warzburg.*, 1914, **1**, 95-119.

## DOUBLE OVARY IN *COCOS NUCIFERA* LINN

THE occurrence of dobule ovary in coconut not reported so far was observed in a coconut fruit with a big "horn" like structure, brought by a student from Tenkasi in Tinnevelly Dist. The 'horn' was of strikingly big size and the length nearing that of the main fruit. The fruit and the 'horn' were sawn into two to study the internal structure (*cf.* Figs. 1 & 2). The bigger fruit was normal in section with the epicarp, the

fibrous mesocarp and the hard endocarp enclosing the kernel. The 'horn' also possessed the above three distinct layers of the fruit; but the endocarp was solid in structure and about 0·25 cm. in thickness.

While the presence of the endocarp gave the indication that the 'horn' is a developed ovary, possibility of its being developed from an apocarpous pistil was investigated. The bigger nut in the present case, on detailed examination, showed that it was normal with three carpels. Hence the 'horn' is not due to any one of the carpels being apocarpous.

'Horned' coconuts (similar to Fig. 3) have been recorded; but regarding the morphology of the horns there is considerable difference of opinion. Masters (1869) considered that they may be due to hypertrophy of perianth segments. Petch (1924) favoured the view that the horns are due to a 'duplication of the segments of the gynœcium.' The generally accepted theory is that of Furtado (1927) who attributed the horns to the development of the staminodes. But the present case is quite different, as the normal ring of staminodes was made out in the younger flowers which were later examined.

The female flowers examined at different stages of growth showed the double ovaried condition in most of the cases. The presence of the hard endocarp in the "horn" also goes to prove that it is developed from a separate ovary. It is of interest that this plant, found in a plantation in Tenkasi produces mostly female flowers with the twin ovaries developing into fruits with horns.

The authors wish to thank Sri. G. V. Narayana, Oilseeds Specialist, Agricultural College and Research Institute, Coimbatore, for his kind help in this investigation.

S. N. CHANDRASEKHARAN.
D. DANIEL SUNDARARAJ.
Botany Section,
Agri. Coll. & Res. Instt.
Coimbatore,
*January* 12, 1950.

1. Masters, M. T., *Vegetable Teratology, Roy. Society*, London, 1869. Petch, T., *Year Book, Dept. of Agric, Ceylon.*, 1924. 3. Furtado, C. X. *Gardner's Bull.*, 1927, **4**, 78-86.

## UNESCO CONFERENCE ON BRAILLE PROBLEMS

AN International Conference on braille problems is being convened by the United Nations Educational and Cultural Organization (UNESCO) from March 20 to 29, 1950. The Director-General of UNESCO has invited Prof. Suniti Kumar Chatterji and Mr. P. M. Advani, Members of the Indian Expert Braille Committee, Mr. Lal Advani, a blind Braillist and Mr. K. V. Padmanabhan, first Secretary, Indian Embassy, Paris, to represent the different lingustic areas of India at the conference.

# REVIEWS

**A General Kinetic Theory of Liquids.** By M. Born and H. S. Green. (Cambridge University Press), 1949. Pp. 98. Price 10 *sh.* 6 *d.*

The six articles published by the authors during the years 1946-48 in the *Proceedings of the Royal Society* are now issued in book form, by way of meeting the great demand for reprints. The subject-matter is the statistical theory of liquids for a proper description of equilibrium and dynamical properties.

In the first article a mathematical formulation of the problem has been made. A complete set of distribution functions for singlets, doublets, triplets, etc., of molecules depending not only on position and velocity, but also on higher derivatives with respect to time has been introduced. The equations of continuity and the equations of motion have been obtained. It is assumed that the intermolecular forces are central. The theory could however be generalised even if the forces are not central ones. If only binary encounters between the molecules be considered, Boltzmann's equation is shown to follow from the equations of motion. The results of the equations of equilibrium are shown to be in agreement with the results of statistical mechanics. In the next paper a generalisation of the famous Boltzmann H-theorem has been made and an explanation of the phenomenon of condensation and the distinction between the liquid and gaseous phases is given.

In the third article the theory of the dynamical properties of liquids has been developed. A set of generalised hydrodynamical equations has been established. It is shown that the pressure tensor and the energy flux vector consist of two parts, one due to the thermal motion and the other due to the intermolecular forces, the former being dominant in the case of gases and the latter in the case of liquids.. Expressions for viscosity and thermal conductivity have been found. Born and Green have explained the phenomenon of condensation as connected with the appearance of analytic singularities in the equilibrium equations and the dynamical constants.

In the fourth article the theory developed in the preceding papers has been translated into the quantum formalism. The classical limit is established and a quantised proof of the Boltzmann law is given. The equation of state shows clear differences at low temperatures. A discussion of the viscosity and the thermal conductivity of quantum liquids is given, thus offering an explanation of the abnormal properties of liquid He II. The authors point out that the previous attempts to explain the properties on the basis of Bose-Einstein statistics are not successful as the interatomic forces have been neglected.

In the fifth paper the thermodynamic properties of systems of arbitrary nature and kind have been established on the basis of quantum mechanics. Entropy is defined and shown to be additive for weakly coupled systems and the general H-theorem is established.

In the last article, Green has examined the theory with special reference to liquid He II. The author has pointed out that that all the properties of He II can be explained by his theory in a way satisfactory to physical intuition and calling for no further assumptions than the accepted laws of quantum mechanics.

There is no doubt that the contribution of Born and Green to the kinetic theory of liquids is a classic one, as it offers a mathematically satisfactory description of the laws of the dynamic and equilibrium properties of liquids, a satisfactory account of the laws of ther no-dynamics from the kinetic point of view and a satisfactory description of quantum liquids. The papers require careful study as they are highly mathematical.

N. S. NAGENDRA NATH.

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**Modern Radio Technique.** A New Series. Edited by J. A. Ratcliffe. (Published by the Cambridge University Press), 1949.

1. *Aerials for Metre and Decimetre Wavelengths.* By R. R. Smith. Pp. xiii + 218. Price 18 *sh.* nett.
2. *Recent Advances in Radio Receivers.* By L. A. Moxon. Pp. x + 183. Price 18 *sh.* nett.

The War years saw a remarkable development of the Radio Technique reflected in the enormous amount of valuable material published in the technical journals since 1945. A number of very valuable books, both advanced monographs and texts, has also appeared from the United States, but the texts do not contain everything, and advanced treatises are beyond the reach of the average student who has examinations to consider and has a limited time at his disposal. Same is the fate of the professional engineer who was familiar with radio technique before the War and who has now little time to

spare to moke his knowledge up to date. To tnese classes, the books published in this series on Modern Radio Technique are a boon. They are written by persons who have themselves made valuable contributions. They are brief and confined to the broad fundamentals. Yet there is enough of all the valuable material that one desires to get familiar with. As one reads through them, one cannot escape noticing the expert hand of the editor who is known to all of us who had the privilege to be his students as an excellent teacher. The books are, therefore, most welcome and constitute a very valuable addition to available literature. No library meant for physics or electrical engineering can afford to do without them. To the students, the series is indispensible.

Smith's book on aerials for metre and decimetre wavelengths is divided into fifteen chapters and covers a wide ground in a most readable manner. Starting from the resonant dipole and the theory of radiation, aerials, aerial arrays, reflectors, high power transmitting aerials, receiving aerials, long wire aerials, wide band aerials, slot aerials, etc., all come up for a balanced and authentic treatment. The book is thus complete in itself for this field. But the reviewer feels that helical antenna should have come up for treatment in a book of this kind.

Moxon's book on Recent Advances in Radio Receivers has really too ambitious a title. Five chapters are devoted to the Noise Factor and this question is gone into in great detail. There is very valuable and useful material here and there could have been a book on this subject only. There is a chapter on I.F. amplifiers, one on Trends in Practical Receiver Design, one on Some New Kinds of Receivers, one on Some New Circuit Tricks. These chapters cannot be considered exhaustive and constitute a weaker link in the book. While it is admitted that it is difficult to draw a line as to how far one can go into details in this field and that valuable literature is difficult to have access to, one cannot refrain from saying that they are rather sketchy. All these chapters have valuable material presented in a very readable form, but none of them can be labelled as complete.

The printing and get-up of the books are excellent. The diagrams are very carefully drawn and well reproduced. In fact, there is very little room for improvement in this direction. The price of the books, *viz.*, 18 *sh.* is rather high and it is to be hoped that this will be reduced when the books go into the second edition.

S. V. CHANDRASHEKHAR AIYA.

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**"Laboratory and Workshop Notes".** Compiled and Edited by Ruth Lang. (Edward Arnold & Co.,) Pp. 272+xii. 1949. Price 21 *sh.* Nett.

Under the title "Laboratory and workshop notes", the Journal of Scientific Instruments has been publishing for the last 25 years as a regular feature, many practical devices and tips generally useful in all research laboratories and workshops. Thereby has been built up a collection of simple, low-cost, elegant and time-saving devices, which have been developed and tested in different laboratories in the course of specific investigations, but which are of common interest and adaptability to others. Informations of this type cannot frequently be incorporated in detail in the body of a research report or publication, as they are comparatively of minor importance and have to give place to more important aspects of the specific research under consideration. Such little details however are extremely interesting and useful and are generally freely interchanged between investigators.

The Institute of Physics has been doing a great service in making such information more widely available through the medium of the journal. It has now taken up the additional step of publishing them in book form, after classifying them suitably, and with a general index.

Dr. Ruth Lang, who was invited to undertake this work has carried out the task in a manner which will be appreciated universally by all Laboratory Scientists. 181 *"Notes"* have been selected, and classified under eight sections, *viz.*: (1) Laboratory and workshop tools, processes and devices, (2) Clamps, supports and agitators, (3) Soldering, bracing and welding, (4) Technique for glass manipulation and silvering, (5) Vacuum and pressure technique and devices, (6) Electrical and magnetic devices and techniques, (7) Optical devices and techniques, (8) Devices for liquids and gases.

To the younger generation especially, the collection will be something of a treasure chest in which to delve for aids to solve the various "little" practical difficulties that arise, particularly in these days when instruments are difficult to get, or are too costly. This volume should be made available in every College and Research laboratory and would indeed be a valuable *vade mecum* for every individual, for laboratory work. The book is well brought up with clear drawings and sketches, and pleasant to read. The royalties from its sale are

reported to be earmarked for the Benevolent Fund of the Institute of Physics.

M. A. G. RAU.

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**Principles of Physics. III. Optics.** By F. W. Sears. (Addison-Wesley Press Inc., Cambridge 42, Mass), 1948. Pp. 369. Price $6.

The book is written for the two year course in General Physics at the Massachusetts Institute of Technology. In this third edition (the first edition was published in 1938 and the second in 1945), several important changes have been made in the order of presentation.

As a text-book of optics, it satisfies the requirements of those students who take physics as the only main subject for the B.Sc. course. Besides the usual chapters in geometrical and physical optics, there are four additional chapters which extend greatly the interest and importance of the book. These are devoted to line spectra, thermal radiation, photometry and colour. The last two chapters present a wealth of detail on illumination engineering and modern colorimetry, which should prove useful to every student of Physics.

Special mention may be made of two interesting aspects. The diagrams are neat and well drawn, with relevant details fully indicated under them. The reader is enabled to understand them without having to look up the text for reference. Further at the end of each chapter, there are several interesting and well-chosen problems. Students of optics would do well to work them out completely.

On two important issues, the reviewer is not in agreement with the author. First, there seems to be no essential justification for taking up polarisation before interference and diffraction. The basic ideas of polarised light, double refraction and light scattering are obviously difficult for the student to comprehend at the beginning and may be profitably kept over till interference and diffraction are finished.

The letter symbols used in geometrical optics are those recommended by the Committee on letter symbols and abbreviations of the American Association of Physics Teachers. One is inclined to prefer the symbols used in British text-books like those of Preston and Edser as much less confusing.

These are matters of opinion. The book is no doubt a welcome addition to the current text-books on optics.

S. R. R.

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**Bibliography of Research on Heavy Hydrogen Compounds.** Compiled by A. H. Kimball and Edited by H. C. Urey and I. Kirshenbaum. 1st Edition. (McGraw Hill Book Co., Inc., New York), 1949. Pp. xiii + 350. Price $3·25.

Ever since its discovery by Urey and his colleagues in 1931, heavy hydrogen (deuterium) has been widely used in one form or other for tracer work. This is mainly due to the comparative ease with which it can be concentrated and the rapidity with which it can be analysed not only with the help of the mass spectrometer but also by the inexpensive and simple falling drop method which takes advantage of the density of heavy water. Thus, for instance, heavy hydrogen and its compounds have been extensively used to test the validity of various theories, where mass effects were suspected: they have also been used in chemical and biological researches such as the one carried out so brilliantly by Schœnheimer and his co-workers on the dynamic state of body constituents. With such diversity of application resulting in the publication of over two thousand papers on the subject, one has reason to welcome a bibliography such as the present volume under review, prepared in the National Nuclear Energy Series, under the auspices of the Manhattan Project and the Atomic Energy Commission of the U.S.A.

The book is a compilation of references to literature published on heavy hydrogen and its compounds and records the achievements of thousands of investigators in different parts of the world. The references are arranged alphabetically according to the name of the senior author of each work. The material has, in addition, been classified according to subject and to help those who may be interested in any particular deuterated compound, a compound index has also been given. Each reference is also identified by a codified letter symbol denoting a particular topic in the subject index. These useful additions serve the purpose of giving a comprehensive picture of the content of each paper and thereby making the bibliography commendably complete in all respects.

References to nuclear reactions as such involving the use of heavy hydrogen have not been included in this volume. There is also no indication as to the year up to which the bibliography is complete and whether the authors plan to bring out an addendum after a definite period of time to include references to recent literature on the subject. In going

through this compilation, one is also puzzled as to where the journals like *Priroda* and *Chem. Obzor* (p. 216) are published and whether *J. Phys. Chem. U.S.S.R.* and *Acta Physicochem U.R.S.S.* (p. 38) are published in one and the same country. It will indeed enhance the value of this book, if an appendix is attached giving the details of where the journals referred to are published.

The get-up of the volume is excellent and the extensive bibliography presented in this volume should prove invaluable to all concerned with researches on heavy hydrogen and its application to specific problems.

P. S. SARMA.

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**The Analytical Chemistry of Industrial Poisons, Hazards and Solvents.** By Morris B. Jacobs. Second Edition. (Interscience Publishers, New York), 1949. Pp. xviii + 788. $ 12·00.

The first edition of this important book appeared in 1941 and was reprinted twice. The present edition is larger by about 130 pages and has been thoroughly revised. With the growth of the chemical industry, increasing numbers of raw materials and intermediates are being used, and a knowledge of the hazards of chemical manufacture is especially necessary for countries which are relatively inexperienced.

Following an introductory chapter on the general aspects of industrial hygiene, sampling methods, measurement of gas volume and quantity, the use of absorbents and the estimation of dust are treated in detail in four chapters. An excellent account of the properties and analysis of inorganic poisons is contained in five chapters, while the remaining eight chapters deal with the industrial hazards, physiological action, detection and estimation of a series of organic compounds. Industrial solvents are treated very fully. References to original literature are profuse, and the book as a whole is a scholarly contribution which will be of great value to every one who has to handle chemicals.

Antimony trioxide is much more important than the sulphides as pigment, but it is not mentioned. A serious omission is DDT, the use of which as an agricultural and domestic insecticide is now so widespread. The statement that the principal commercial toluidine is the *ortho* compound is erroneous. Nitrobenzene is a largely used solvent in the dyestuff industry and the more serious hazards are in handling nitrobenzene as a solvent at high temperatures. The toxic properties of benzidine, the chlorotoluidines and the naphthylamines should have been mentioned. According to Goldblatt (*British Medical Bulletin*, 1947, **4**, 405), "the manafacture of benzidine should be regarded integrally as a hazard from start to finish, and the base should be prepared only if the plant design is such as to preclude absolutely any maintained contact with, or exposure to, dust of the final product." The convenient, although non-specific, bromine absorption method for estimating styrene is not mentioned.

Several errors in printing have been noticed, such as 'naphthaline, carmium, momoxide and sterol' (for styrol or styrene). Pages 361-92 are missing, and have been replaced by pages 523-54 in the reviewer's copy. Carbon tetrachloride and amyl acetate are not solvents for lac. Chloroprene is 2-chloro-1 : 3 (and not 1 : 2)-butadiene. On p. 688 and 704 (lines immediately below equations), 6 mols. of iodine and bromine should read as 3 mols. or 6 atoms. The equation on p. 718 is incorrect.

K. V.

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**Thermodynamics Rewritten.** By S. K. Dhar. (The New Sketch Press, Dhanbad), 1949. Pp. 34. Price Re. 1.

Some books are to be chewed and digested while others are to be eschewed. The small booklet under review clearly belongs to the latter category. In spite of the large bibliography of standard books at the end of the booklet, the author does not appear to have fully grasped the theory that he attempts to criticise. From the start, there are instances of confusion between reversible and irreversible processes and between a system in equilibrium with its surroundings and a strictly isolated system. This is clearly shown in the examples indicated in the second chapter. The third and fourth chapter similarly indicate the author's limitations. If he had only considered the fact that in the Electrolux where the working substance is a solution of ammonia the energy requirements for maintaining the same degree of refrigeration is much more than with other forms of refrigeration, the chapters would not have been written! The statistical basis of the Second Law, and variations of the heats of reaction with temperature do not appear to have reached the author and the crowning tragedy is seen in his chapter on thermochemistry. Production of water gas is an endothermic reaction and if some one does not provide the energy to keep the carbon hot our author's engine will have to stand still in spite of his calculated efficiency.

S. V. A.

**The Elements of Genetics.** By C. D. Darlington and K. Mather. (George Allen & Unvil Ltd., London), 1949. Pp. 446. Price 25 *sh.* net.

This recent publication by two of the foremost geneticists of England will be widely welcomed by all students of plant and animal genetics. The word Elements in the title is intended to mean essentials and principles, but the subject is by no means treated in an elementary way. Plant and animal genetics are not separated nor given undue importance, but the science of genetics as a main branch of biology is built up from its elements.

The mode of treatment is analytic as well as synthetic, and not descriptive or experimental. A general knowledge of heredity, cytology and evolution, of both plants and animals, is prerequisite to follow the close reasoning in this book. The labour of following the arguments is well worthwhile, for the authors have so many new ideas and perspectives to present. Such a comprehensive treatment of the subject has probably not been given in any other English book, nor will probably be tried again in this vigorously expanding science.

The subject-matter is divided into three parts, relating to individuals, cells, and populations. In the first part, the mendelian and biometric aspect of heredity is dealt with, and includes the chromosomal basis of inheritance. In the second part, the organisation of cells is discussed in its relation to development and heredity. The topics of this part are Genes, Molecules, Processes, Cytoplasm, Development, Differentiation, Viruses, Proviruses and Conflict of Systems. In this part, very recent and topical subjects such as the relation of cytoplasm to gene action, and the probable biochemical processes of gene action, are discussed. In the last part, the genetic systems as consisting of natural populations of plants and animals are discussed. Also a consideration of human populations and human genetics is included, and scientists of India and Pakistan would be much interested (and probably irritated) by the way the authors sum up the genetic consequences of the Hindu and the Islamic social systems.

On first studying this book, the reviewer felt very strong disagreement with some statements, inferences and arguments. On reading the book again, the treatment adopted was seen to be so able, that it was obvious that any criticism must be carefully considered, and advanced by the expert in the topic concerned. The late Dr. Belling produced a booklet out of his critical notes of Dr. Darlington's Recent Advances in Cytology. A second Dr. Belling, who is an expert in protein and enzyme chemistry as well as in modern genetics, is needed to prepare critical notes on this book. Only this opinion can be advanced now; the style of the book is vigorous rather than rigorous. The style of some eminent scientists who marshall evidence for as well as against a particular view, is not here adopted, possibly because of the vast extent of the subject to be covered. Those who wish to secure a different view-point have to refer to other books and reviews. Critical readers are to keep in mind the authors' words in the preface, that they have taken "the hazardous method of using the knowledge of a mapped area to fill in the empty spaces with more likely assumptions". In connection with a discussion on the evolution of angiosperms as revealed by a study of chromosome numbers, the authors also state that "conjectures conjoined become verifiable predictions".

The glossary of technical terms given as Appendix I, to the books is a very useful addition. The technical terms, as well as the English language, have been used with great skill throughout the book, as can be expected from the authors. In spite of this skill, there is some obscurity in construction, possibly because Indian language construction and modes of thought are different. Three examples of the unusual use of words may be cited. "Broken tulips" in page 209, refers to tulips affected by a specific virus. The statement "This supergene is Sex-Ratio" is difficult to understand even if the definitions of both the words are learnt. The title "The special uses of Man" in page 349 refers to advantageous features in human genetics. The large number of figures used to illustrate the text are of great help, but few like Fig. 87, p. 357 are obscure.

The get-up of the book is excellent. Only printing mistakes detected are two omissions of letter 'B' on page 378.

C. G.

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**Manual of Bacterial Plant Diseases.** By W. J. Dowson. (Adam & Charles Black, London), 1949. Pp. 179. Price 16 *sh.*

Dr. Dowson's book meets the long felt need of the student of plant pathology. It is true that a greater number of workers are engaged in the study of fungal diseases than of bacterial diseases of plants. This is no doubt partly due to the abundance and easy availability of literature on fungus diseases.

The book is divided into 12 chapters, the 1st four chapters dealing with general characteris-

tics of bacteria, nomenclature, methods of investigation etc. The nomenclature of bacteria seems to be a never ending contraversy, and it is doubtful whether Dowson's treatment of *Erwinia* as synonym of *Bacterium* will find general acceptance. Chapters five to seven are devoted to general staining and cultural methods of studying bacteria which are concisely and neatly presented.

In chapters eight to twelve, important bacterial diseases of several economic plants are given. For several of the important bacterial plant pathogens, distribution, symptoms, etiology and control of the disease are given. A brief account of the morphological and cultural characteristics of the bacteria would have been a welcome and useful addition. The photographs illustrating the disease symptoms are excellent. There are eighteen distribution maps included in the last chapter. Too much credence however should not be placed on these, since there is the possibility of the pathogene having been overlooked in a particular locality. As an instance in point, *Xanthomonas campestris* inciting black rot of cabbage is common in Northern India, introduced perhaps from imported seeds. By solely relying on the distribution maps one is led to believe that it does not occur in India at all. This book should be welcomed by all students and investigators in plant pathology.

M. J. NARASIMHAN.

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**The Chemotherapy of Tuberculosis**. *The Experimental Approach*. By Max B. Lurie, Geoffrey Rake, Richard Donovick, Selman Waksman and 31 other authors. *The Annals of New York Academy of Sciences*, Vol. 52. Art. 5. Pages 625-788. (New York: Published by the Academy). December 14, 1949. Price $2·50.

The publication—Vol. 52. Art. 5 of the *Annals of the New York Academy of Sciences*—is a collection of scientific contributions and reports of researches on the experimental approach of Chemotherapy of Tuberculosis. Distinguished workers who are actively engaged in the field have contributed to this important subject in the volume under review.

It is interesting to note that an attempt has been made to include in the programme those aspects of the problem that are particularly pressing at this time. Tuberculosis has remained stubbornly resistant to chemical agents and all attempts to treatment of experimental and clinical tuberculosis have not been very promising so far. There are many obstacles that face the investigators who desire to carry on a comprehensive study of chemotherapy of experimental tuberculosis; but with the development of the modern technics of producing experimentally in animals the disease with fairly identical characteristics and consistent morbid states, a new impetus has been provided for attack on this important problem.

Each contributor has made a clear presentation of his topic with the common objective of arousing a widespread interest in the magnitude of the problem that confronts the experimentalist in tuberculochemotherapy. The use of rabbits, guineapigs, Syrian hamsters, mice and chick in experimental tuberculosis has been fully discussed by different authors. Tuberculosis is a complex immunologic and cytologic response which varies from one species to another and from one animal to another within a species. Karlson and Feldman in their article on "the use of guineapigs" have sounded a note of warning that one should be careful and reserve judgment about the clinical use of any chemotherapeutic agent found effective in susceptible animals. To obtain as complete an information as possible regarding the efficacy of anti-tuberculosis agents, these should be tested in more than one laboratory animals now available. But still then, one should maintain a conservative attitude and recognise that from the standpoint of chemotherapy, much evidence is needed before the question as to the rationality for successful transfer of results from experimental animal to man can be answered.

Of the thousands of synthetic compounds and drugs of natural origin that have been tested in various ways for their activity against tubercle bacillus very few have shown enough promise to merit clinical trial. Smith, *et al.*, have dealt with the evaluation of the sulphones and streptomycin in experimental tuberculosis. Dealing with experimental evaluation of synthetic drugs French has laid particular stress on the contemporary theories of drug action and on the selection of drugs for screening. Dealing with the drugs of natural origin Hobby *et al.*, have reported methods for the evaluation of neomycin and other antimicrobial agents of bacterial and fungal origin and substances from higher plants. Little can be said at present concerning the chemotherapeutic potentialities of antimicrobial agents that reside in higher plants, yet studies on them serve to emphasise the abundance of such substance in nautre and offer great possibilities of finding new agents which will prove to be effective in the treatment of tuberculosis.

The volume represents a very stimulating

contribution to the subject of chemotherapy of tuberculosis and indicates that research in this line offers rich possiblities for the investigators who has energy, imagination, patience and enthusiasm. N. N. De.

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**Bengal Famine (1943)—As Revealed in a Survey of the Destitutes in Calcutta.** By Tarakchandra Das, Lecturer in Anthropology, Calcutta University. 1949.

The volume under review records the results of a survey conducted by the author and his trained collaborators on a representative group of 2,537 destitutes that had gathered in Calcutta, as a result of the Bengal Famine in 1943. A number of interesting points emerge from this investigation:—

1. The largest number of persons were in the age-group 0-10 years, the smallest in the group 50-60 years. The sex-distribution of male to female is interesting; in the age-group 0-15 years, males were about 30 per cent. and females 22 per cent. against the Bengal census figures of about 20 and 18 respectively. But in the age-group 15 to 60 years the percentage of males to females in the survey stood at 16 and 30 respectively as against the census figures 32 and 27. The author has discussed the reasons for the high percentage of females in this age group. It was elicited in the survey 32·4 per cent. of the males and 21·4 per cent. of the females of the marriageable age were unmarried and 13 per cent. males and 23 per cent. females were married. In the author's view, the marital status is an index of the economic well-being.

There was no significant difference in the marital condition of the three principal communities among the destitutes. The scheduled castes formed the largest number of the destitutes, being 53·68 per cent., Muslims 27·63, Caste Hindus about 18 per cent. and Christians less than one per cent. The destitutes came from about 12 districts of which the largest were from Howrah, Nadia, Hooghly, Burdwan and Dacca; others being comparatively small. The acuteness of distress was well indicated by the distance covered by the destitutes to reach Calcutta with all the difficulties and obstacles of transport from the distant districts like Dacca. The causes of the destitution and dislodgment according to the destitutes' statements were lack of food and work, floods, cyclone, failure of crops, family dissension, military occupation. The occupation of the destitutes was mainly agriculture, comprising about 22 per cent., daily labourers 14 per cent., the rest belonging to various arts and crafts. It was observed the rigidity of all social and religious conventions simply vanished during the famine.

The causes of death among the destitutes were found to be starvation, bowel complaints and others. The highest mortality was in the first age-group, infant and children 33 per cent.; the next highest was in the second age-group 15 per cent. It was ascertained that 73 per cent. of the sample population were agriculturists or agricultural labourers. The high mortality among the children will no doubt tell heavily on the next generation of the agricultural population of Bengal, as well as affect its food production very seriously.

Another interesting point observed was that the mortality among the males was higher than among females; this is in conformity with the findings from previous famines in other provinces. The author has given reasons for this feature.

The author concludes by stating the basic and contributory causes of the famine.

2. In Part 2 the author describes a similar survey of a more limited character. This rural survey was of a very restricted character owing to lack of resources. Therefore it was confined to a few villages of some of the seriously affected districts of Burdwan, Midnapur, Hooghly, Howrah, Dacca, etc. Altogethr 1,019 families were studied consisting 4,073 persons. 53 per cent. belonged to the scheduled caste, about 29 per cent. were Caste Hindus and 18 per cent. Muslims. In the village data, the sex proportion of the affected population was the same. In the three communities it was found in the village survey the unmarried males were larger in number than the unmarried females. The number of married men is lower than married women. Regarding occupation, the agriculturists formed the highest percentage. Other important aspects: indebtedness, reduction of social status, etc., are discussed. Here again starvation accounted for 80 per cent. of the total number of deaths; the highest number being in the age group 0-5 years.

The memoir is an able presentation of facts collected by a trained team of workers under the expert supervision of the author.

K. P. Menon.

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## OBITUARY

### Dr. N. C. Chatterjee

We regret to announce the death of Dr. N. C. Chatterjee, lately Forest Entomologist, at the Forest Research Institute, Dehra Dun, on 20th Feb. 1950.

# SCIENCE NOTES AND NEWS

### Dr. S. L. Hora

Dr. S. L. Hora, Director, Zoological Survey of India, has been admitted as a corresponding member of the Zoological Society of London. Also, he has been invited to serve on the Editorial Board of the journal *Evolution* (International Journal of Organic Evolution published by the Society for the Study of Evolution).

### Recognition for L.Ag.

The Government of India have, in consultation with the Union Public Service Commission, decided to recognise the Licentiate in Agriculture of the Government Agricultural College, Kanpur, of the year 1930 as equivalent to the B.Sc. (Agriculture) degree of the year 1931 of that College for purposes of employment under the Government of India.

### Unesco Fellowships for Training in Librarianship

As alerady announced, the United Nations Educational and Cultural Organisation has offered two Fellowships in the fields of librarianship and scientific literature classification respectively, which will enable two scholars from India to undertake study and travel abroad for a maximum period of six months.

Since the previous Press Note on the subject was issued, it has been decided to extend the last date for the receipt of applications for the abovementioned fellowships up to March 31, 1950.

The Government of india have also decided to meet the cost of travel of the selected scholars from India to the country of study. Unesco will provide for the payment of one way travel from the country of study to India.

### U. S. Scholarship for Indian Students

The Colorado School of Mines, Golden Colorado, U. S. A., have offered one scholarship to an Indian student to pursue studies in any one of the following subjects: Coal and metal mining, metallurgy, petroleum refining, production and utilization of cement, refractories, clay and other non-metallic minerals. The scholarship is offered for one year 1950-51 and is renewable up to a maximum period of four years. The value of the scholarship is $ 425 to $ 475 per annum which covers all tuition fees. It makes no provision for living, transport or other personal expenses.

Candidates must be *bonafide* residents of India and must possess a good degree in Science or Engineering from one of the recognised Universities and technical institutions in India including the Dhanbad School of Mines, West Bengal. Proficiency in English is essential.

Intending candidates must submit their applications in the prescribed forms through their respective Universities or technical institutions so as to reach the Ministry of Education (Section A. I.), New Delhi, not later than April 20, 1950. Copies of the prescribed form can be had from all the universities and technical institutions who have been requested to recommend not more than two names each.

### Madras University Prizes

The *Sir William Wedderburn Prize* for 1951 will be awarded by the Madras University to the student who, having qualified in Chemistry for the degree of B.Sc. (Hons.) or M.Sc. not more than two years previously, has shown aptitude for research. A thesis on any research work conducted by the student should accompany the application. The prize will consist of books to the value of Rs. 45. Competitors should submit their theses so as to reach the Registrar not later than 30th April 1951.

The *Maharaja of Travancore—Curzon Prizes* for 1950-51, one in each of the following group of subjects, will be awarded by the Syndicate of the Madras University for the best essay or thesis written by any graduate of the Madras University on any topic dealing with one of the subjects mentioned in the following two groups:

| B | C |
|---|---|
| Botany | Mathematics |
| Zoology | Physics |
| Physiology | Experimental Engineering. |

The value of each prize is Rs. 250.

Competitors should submit their theses to the Registrar not later than 1st March 1951.

### Award of Research Degree

On the recommendation of an Examiners' Board consisting of Sir C. N. Hinshelwood, Kt., F.R.S., Prof. R. P. Bell, F.R.S., and Prof. R. S Krishnan, the Ph.D. of the Benares Hindu University was conferred on B. N. Prasad, M.Sc., for a thesis on "Comparative Joshi-Effect in Chlorine and Mercury Vapour".

Editor: M. Sreenivasaya, B.A., F.I.I.Sc., F.A.Sc.
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